THE LANCET
Respiratory Medicine

Supplementary appendix

This appendix formed part of the original submission and has been peer reviewed. We post it as supplied by the authors.

Supplement to: Fang L, Gao P, Bao H, et al. Chronic obstructive pulmonary disease in China: a nationwide prevalence study. *Lancet Respir Med* 2018; published online April 9. http://dx.doi.org/10.1016/S2213-2600(18)30103-6.

Supplementary Material

Chronic Obstructive Pulmonary Disease in China: a Nationwide Prevalence Study

eAppendix 1 Detailed descripton of the sampling strategy

The first level of sampling was stratified by three areas (East, Central, and West) for the consideration of the different levels of economic development across country. The second level of sampling was stratified by urban and rural locations. Within each location, the DSPs were randomly selected within the system with probability proportional to the population size of the locations. At least two DSPs were selected within each province/autonomous region/municipality. A total of 125 surveillance points in 31 provinces were used (**eFigure A1**). At each DSP, three sub-districts in urban areas or townships in rural areas were randomly selected in the 4th stage. Then two neighborhood communities or administrative villages were randomly chosen within each sub-district/township. One group of villagers with at least 150 households was randomly selected within each neighborhood community or administrative village. At last, 100 households within each group of villagers were randomly chosen. In the final stage, one family member who was at least 40 years old was selected randomly from each household using a Kish selection table.

eFigure A1 Locations of disease surveillance points (DSPs) used in the survey.

eAppendix 2 Detailed descripton of spirometry procedures

The procedure for spirometry followed the recommendation by American Thoracic Society. It was applied to all eligible subjects by trained staff. Spirometers (MasterScreen Pneumo, Jaeger, Germany) were used in the study. All participants without the following conditions underwent spirometry examination: (a) had thoracic, abdominal or eye surgery within 3 months; (b) had coronary heart disease events within 3 months; (c) had massive hemoptysis within 1 month; (d) had stroke events within 1 month; (e) systolic blood pressure ≥ 180 mmHg or diastolic blood pressure ≥110 mmHg; (f) patients with aortic aneurysm; (g) patients with severe hyperthyroidism; (h) patients under the treatment for epilepsy; (i) patients with active tuberculosis or under antituberculous treatment; (j) patients with history of retinal detachment; (k) patients with facial paralysis.

Spirometry examination for subjects with the following conditions was postponed by at least 24 hours: (a) used short-acting inhaled bronchodilator within 6 hours; (b) used short-acting beta$_2$-agonists and theophylline within 12 hours; (c) used long-acting inhaled bronchodilator, corticosteroids (inhaled, oral, intravenous or intramuscular injected), long-acting beta$_2$-agonists, oral long-acting theophylline, or intravenous methylxanthines (theophylline or aminophylline) within 24 hours; (e) used leukotriene modifiers within 72 hours. For the subjects who smoked within 1 hour, the examination was postponed by 1 hour. Subjects with respiratory infection within 1 month were invited to receive the spirometry examination after 1 month.

After the initial spirometry examination, subjects who were allergic to salbutamol or had resting heart rate ≥100 were further excluded for post-bronchodilator test. A dose of 400 μg of salbutamol (Ventolin, GlaxoSmithKline, Middlesex, UK) was used for each eligible participant. Post-bronchodilator spirometry test was repeated after 15 minutes. Both pre- and post- bronchodilator forced vital capacity (FVC), forced expiratory volume in the first second (FEV_1), forced expiratory volume in the six seconds (FEV_6) and the peak expiratory flow (PEF) were measured.

For spirometry results, as applied in previous literatures, a quality grade (A, B, C, D, F) based on acceptable maneuvers and repeatability of the FEV_1 and FVC were used: ”A” was referred as at least three acceptable maneuvers with the largest two FEV_1s matching within 0.1L and the largest two FEV_6s matching within 0.1L; ”B” was referred as at least two acceptable maneuvers with FEV_1s matching within 0.15L; ”C” means at least two acceptable maneuvers with FEV_1s matching within 0.2L; ”D” means only one acceptable maneuver (with no interpretation unless normal); ”F” means no acceptable maneuvers (with no interpretation). Grade A, B or C were considered acceptable for analysis. Examination with grade D and F were required to be tested again. Quality control for the spirometry procedure were conducted within 24 hours.

eAppendix 3 STROBE checklist

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Reported on page
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1, 2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2, 3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	6
Objectives	3	State specific objectives, including any prespecified hypotheses	6
Methods			
Study design	4	Present key elements of study design early in the paper	6 and eAppendix 1
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7, 8 and eAppendix 2
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7, 8, 9
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7, 8 and eAppendix 2
Bias	9	Describe any efforts to address potential sources of bias	9, 10, 11
Study size	10	Explain how the study size was arrived at	10, eFigure1, eTable 1, and eTable 2
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	10
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	10, 11
		(*b*) Describe any methods used to examine subgroups and interactions	10
		(*c*) Explain how missing data were addressed	10 and eTable 3
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	10 and eAppendix 1
		(*e*) Describe any sensitivity analyses	15 and eFigure 2
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	10 and eFigure 1
		(b) Give reasons for non-participation at each stage	eTable 1 and eTable 2
		(c) Consider use of a flow diagram	eFigure 1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Table 1, eTable 5 and eTable 8
		(b) Indicate number of participants with missing data for each variable of interest	eTable 3

Outcome data	15*	Report numbers of outcome events or summary measures	Figure 2, Table 2 and eTable 4
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	eTable 4
		(*b*) Report category boundaries when continuous variables were categorized	Table 2 and Table 4
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Table 3 and eTable 6
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Table 2, eTable 11 and eTable 12
Discussion			
Key results	18	Summarise key results with reference to study objectives	14
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	18, 19
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	14, 15, 18, 19
Generalisability	21	Discuss the generalisability (external validity) of the study results	15, 18
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	3, 11

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

eAppendix 4 Systematic literature search procedures

Data Sources and Searches

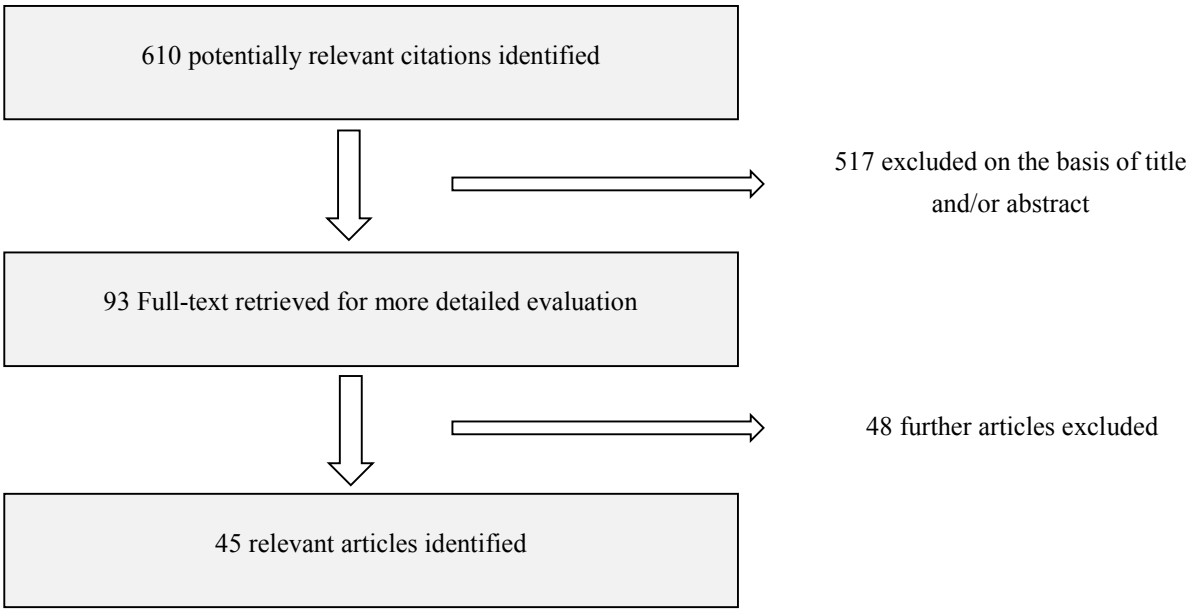
Studies published between January 1990 and February 2018 were identified, with journals' languages restricted to Chinese and English, through electronic searches using PubMed, EBSCO, SinoMed (China BioMedical Literature Service System), CNKI (China National Knowledge Infrastructure), Wanfang Database (Chinese). These searches used free text and medical subject heading terms. Search terms included 'COPD', 'CAL', 'asthma', 'chronic obstructive pulmonary disease', 'chronic obstructive lung disease', 'chronic obstructive respiratory disease', 'chronic obstructive airway disease', 'chronic airflow limitation', 'prevalence', 'epidemiology', 'epidemiological', and 'China'.

Study Selection and Data Extraction

Original studies were included if they had reported a prevalence number for the community population in China on chronic obstructive pulmonary diseases (COPD). Studies were eligible for inclusion if satisfied all of the following criteria: 1) chose participants through a random selection procedure from community population; 2) had information of the prevalence for COPD among the population aged ≥40 years; 3) had a clear definition on the disease of COPD; 4) diagnosed the COPD patients through pulmonary function tests or self-report methods. Studies were excluded if they: 1) presented data on a study population that had already been included; 2) presented data obtained from the hospitals, health examination centers or specific populations that were not deemed to be representative of the general population (eg, soldiers, workers, or community volunteers); 3) did not report data on the number of participants; 4) did not provide information on data collection methods or diagnostic criteria; 5) were reviews or comments. A literature search flow chart is provided below.

Data on the following characteristics were extracted independently by two investigators (HB and KL) according to a pre-specified protocol: full study name, study location (cities, rural/urban), sampling methods, diagnostic methods, number of participants and number of cases. Discrepancies were resolved by discussion and by adjudication of a third reviewer (XT).

eFigure A1: Literature search flow chart



eTable A1: Study information of the 45 studies identified in the systematic review.

First author	Publication year	Area	Urban/ Rural	Sampling method	Diagnostic method	Diagnostic standard	No. of subjects	No. of cases	Prevalence (%)
Ruan(1)	2000	Jiangsu	U+R	C	SR	QS	16813	594	3.5
Qiu(2)	2005	Yunnan	U	M	SR	QS	5791	116	2.0
Li M(3)	2005	Liaoning	R	C	P	PRE	2010	138	6.9
Weng L(4)	2005	Zhejiang	U+R	M	P	POST	1152	103	8.9
Ma R(5)	2005	Shanghai	U+R	S	P	POST	1214	147	12.1
Weng HX(6)	2005	Zhejiang	U	C	P	PRE	1209	79	6.5
Xu F(7)	2005	Jiangsu	U+R	M	SR	QS	29319	1744	5.9
Zhang MY(8)	2006	Shandong	R	C	P	POST	410	28	6.8
Weng JL(9)	2006	Guangdong	U+R	C	P	POST	1100	138	12.5
Zhong NS(10)	2007	National	U+R	M	P	POST	20245	1668	8.2 (7.9-8.6)
Jiang RG(11)	2007	Hubei	R	M	P	POST	1883	186	9.9
Yu CL(12)	2009	Hebei	R	M	P	POST	1948	209	10.7
Cai L(13)	2009	Yunnan	R	M	SR	QS	6006	401	6.7
Wang C(14)	2010	Shandong	U	M	P	POST	2055	156	7.6
Xia T(15)	2010	Sichuan	U+R	M	P	POST	974	141	14.5
Chen QH(16)	2010	Beijing	U	N	P	POST	600	124	20.7
Weng HA(17)	2011	Chongqing	U	M	P	POST	2024	160	7.9
Fu X(18)	2011	Hunan	U	C	P	POST	1000	91	9.1
Wang YY(19)	2011	Zhejiang	U+R	C	P	POST	1467	239	16.3
Liu A(20)	2011	Yunnan	U	M	P	POST	2193	92	4.2
Gong Y(21)	2011	Shanghai	U	C	P	PRE	710	104	14.6
Li ZJ(22)	2011	Shandong	R	M	P	POST	4047	347	8.6
Hong XQ(23)	2012	Hunan	U+R	C	P	POST	8243	417	5.1 (0.8-9.4)
Cai XZ(24)	2012	Guangdong	R	C	P	POST	1019	104	10.2
Qiu J(25)	2012	Ningxia	U+R	M	P	POST	4055	360	8.9
Tang WL(26)	2012	Heilongjiang	R	C	P	POST	1059	170	16.1
Hou G(27)	2012	Liaoning	U	C	P	POST	2194	112	5.1
Chen Y(28)	2014	Sichuan	U	C	SR	QS	347	34	9.8
Peng DQ(29)	2014	Sichuan	U+R	M	P	POST	631	73	11.6
Zhu LL(30)	2014	Xinjiang	R	C	P	POST	2874	216	7.5
Lv XD(31)	2015	Zhejiang	U	M	P	POST	1056	145	13.7
Zhang CH(32)	2016	Fujian	R	C	P	POST	1123	144	12.8
Yin Y**(33)	2016	Liaoning	R	N	P	POST	1994	144	7.2
Li G(34)	2016	Shanghai	U+R	C	P	POST	3842	378	9.8
Pan DY(35)	2016	Guizhou	U+R	M	P	POST	1257	60	4.8
Lin FR(36)	2016	Zhejiang	U	S	P	PRE	1020	130	12.7
Zhou L(37)	2016	Jiangsu	R	M	P	POST	556	66	11.9
Yang HF(38)	2016	Zhejiang	U+R	M	P	POST	585	85	14.5
Duan SH(39)	2017	Gansu	U+R	M	P	POST	1424	190	13.3
Liu YD(40)	2017	Hubei	R	C	P	POST	1078	104	9.6
Zhao SE(41)	2017	Hunan	U	M	P	POST	881	57	6.5
Lv HL*(42)	2017	Guangdong	U	C	P	POST	1583	203	12.8
Chen D(43)	2017	Sichuan/Yunnan/Guizhou	U+R	M	P	POST	1768	145	8.2
Yan RH(44)	2017	National	U+R	M	P	PRE	43078	3690	8.6
Huang JH(45)	2018	Jiangsu	U	M	P	QS+POST	2491	201	8.1

* Male only
** Female only
U: urban; R: rural; M: multi-stage cluster random sampling; C: cluster random sampling; S: simple random sampling; N: not availabel; P: pulmonary function tests; SR: self-report methods; POST: post-bronchodilator spirometry examination FEV1/FVC<0.7; PRE: pre-bronchodilator spirometry examination FEV1/FVC<0.7; QS: questionnaire or scale.

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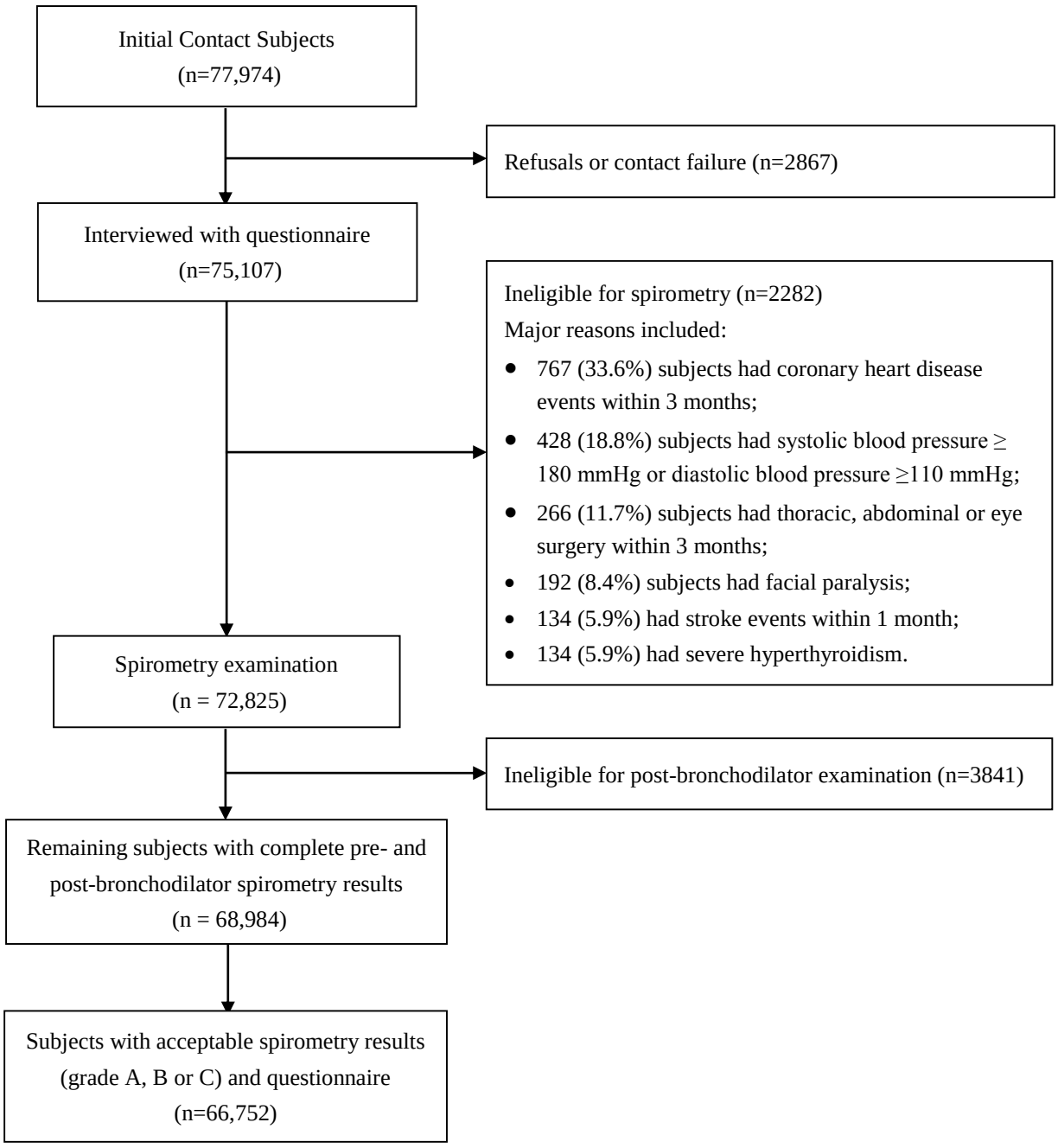
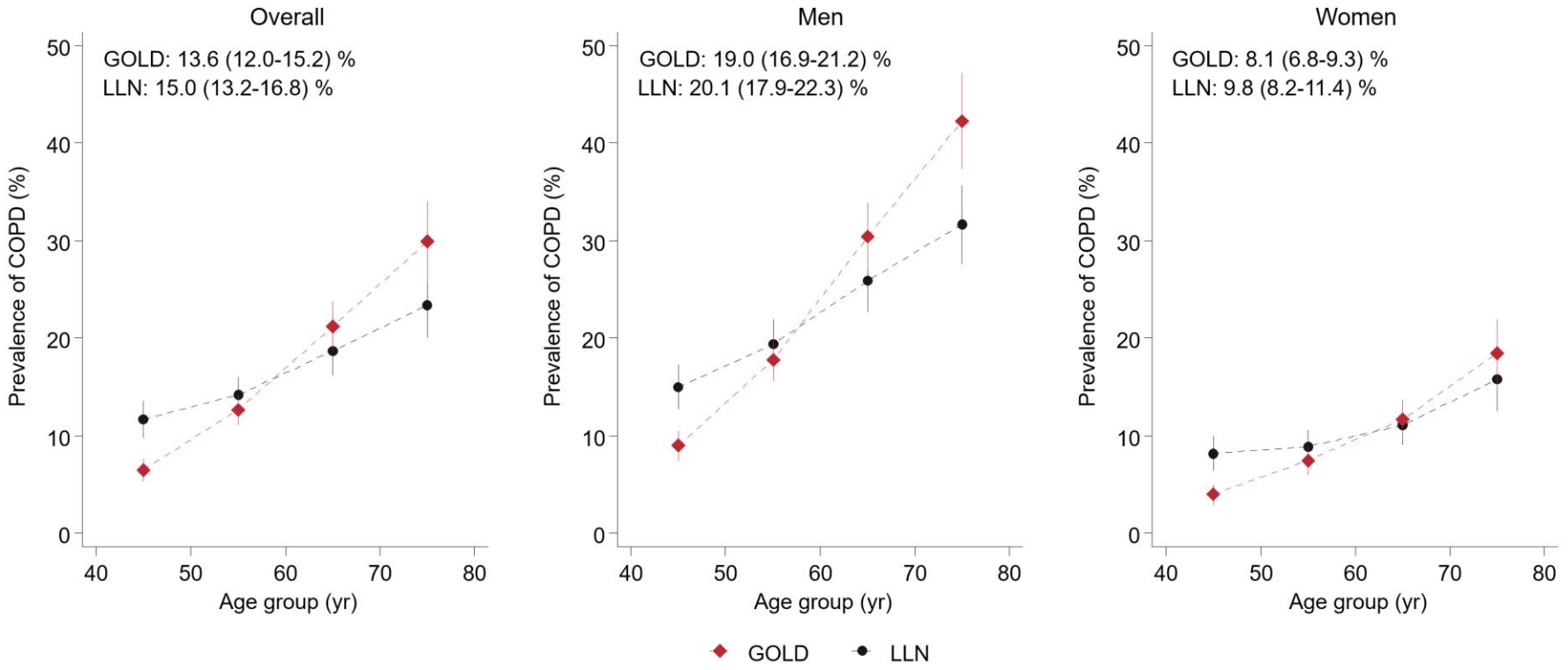
eFigure 1 Flowchat on selection of study participants in the survey.



eFigure 2 **Prevalence of COPD using LLN reference in China**



eTable 1 AAPOR outcome rate calculator (Panel of in-person household surveys)*

	Final Disposition Codes	COPD survey in 2014-2015
Interview (Category 1)		
Complete (all versions)	1.0/1.10	72,825
Partial (all versions)	1.2000	2,282
Eligible, non-interview (Category 2)	2.0000	
Refusal and breakoff (phone, IPHH, mail, mail_U)	2.1000	593
Refusal (phone, IPHH, mail, web)	2.1100	0
Household-level refusal (phone, IPHH, mail, web)	2.1110	1,036
Known-respondent refusal (phone, IPHH, mail, web)	2.1120	277
Non-contact (phone, IPHH, mail, web, mail_U)	2.2000	604
Respondent unavailable during field period (IPHH, mail, mail_U)	2.2500	115
Other, non-refusals (phone, IPHH, mail, web, mail_U)	2.3000	242
Total sample used		77,974
I=Complete Interviews (1.1)		72,825
P=Partial Interviews (1.2)		2,282
R=Refusal and break off (2.1)		1,906
NC=Non Contact (2.2)		719
O=Other (2.0, 2.3)		242
Response Rate 1		
I/(I+P) + (R+NC+O) + (UH+UO)		0.934
Response Rate 2		
(I+P)/(I+P) + (R+NC+O) + (UH+UO)		0.963
Response Rate 3		
I/((I+P) + (R+NC+O) + e(UH+UO))		0.934
Response Rate 4		
(I+P)/((I+P) + (R+NC+O) + e(UH+UO))		0.963
Cooperation Rate 1		
I/(I+P)+R+O)		0.943
Cooperation Rate 2		
(I+P)/((I+P)+R+O))		0.972
Cooperation Rate 3		
I/((I+P)+R))		0.946
Cooperation Rate 4		
(I+P)/((I+P)+R))		0.975

Abbreviations: AAPOR: American Association for Public Opinion Research

* This standardized table to calculate response rates, cooperation rates and completion rates was developed by American Association for Public Opinion Research (AAPOR) and downloaded from www.aapor.org, version 4, May 2016. Contents listed in the original table but not applicable for this survey were not listed.

eTable 1 (continued) AAPOR response rate calculator (Panel of in-person household surveys)*

	Final Disposition Codes	COPD survey in 2014-2015
Refusal Rate 1		
R/((I+P)+(R+NC+O) + UH + UO))		0.024
Refusal Rate 2		
R/((I+P)+(R+NC+O) + e(UH + UO))		0.024
Refusal Rate 3		
R/((I+P)+(R+NC+O))		0.024
Contact Rate 1		
(I+P)+R+O / (I+P)+R+O+NC+ (UH + UO)		0.991
Contact Rate 2		
(I+P)+R+O / (I+P)+R+O+NC + e(UH+UO)		0.991
Contact Rate 3		
(I+P)+R+O / (I+P)+R+O+NC		0.991

Abbreviations: AAPOR: American Association for Public Opinion Research

* This standardized table to calculate response rates, cooperation rates and completion rates was developed by American Association for Public Opinion Research (AAPOR) and downloaded from www.aapor.org, version 4, May 2016. Contents listed in the original table but not applicable for this survey were not listed.

eTable 2 Numbers of participants, numbers of replacements and the replacement rates in each province

	No of participants	No. of replacement	Replacement rate (%)
Overall	75107	2867	3.8
Beijing	1200	6	0.5
Tianjin	1198	4	0.3
Hebei	3011	42	1.4
Shanxi	2424	0	0.0
Inner Mongolia	2385	61	2.6
Liaoning	2397	90	3.8
Jilin	1795	102	5.7
Heilongjiang	3600	180	5.0
Shanghai	1203	34	2.8
Jiangsu	3600	209	5.8
Zhejiang	2997	176	5.9
Anhui	2996	109	3.6
Fujian	2407	74	3.1
Jiangxi	2399	2	0.1
Shandong	3585	114	3.2
Henan	3600	63	1.8
Hubei	2389	120	5.0
Hunan	2992	78	2.6
Guangdong	3690	430	11.7
Guangxi	2757	93	3.4
Hainan	1199	185	15.4
Chongqing	1771	128	7.2
Sichuan	3601	197	5.5
Guizhou	2599	56	2.2
Yunnan	3000	106	3.5
Tibet	1262	9	0.7
Shaanxi	1799	10	0.6
Gansu	1880	52	2.8
Qinghai	1796	5	0.3
Ningxia	1800	126	7.0
Xinjiang	1775	6	0.3

When the selected individual was not available (or refused to participant), a replacement was then chosen from all households of similar composition in the same neighbourhood or village after excluding the already selected households using the simple random sampling method. The replacements were used to ensure an adequate sample size within each selected community.

eTable 3 General characteristics of participants included and excluded in the analysis*

	Subjects excluded	Subjects included	*p*-value
Total	8355	66,752	
Age group			
40-49 yrs	1888 (22.6)	21620 (32.4)	<0.0001
50-59 yrs	2392 (28.6)	22134 (33.1)	
60-69 yrs	2561 (30.7)	17321 (26.0)	
≥70yrs	1514 (18.1)	5677 (8.5)	
Sex			
Male	4175 (50.0)	33137 (49.6)	0.5717
Female	4180 (50.0)	33615 (50.4)	
Residence			
Urban	3693 (44.2)	32009 (48.0)	<0.0001
Rural	4662 (55.8)	34743 (52.0)	
Educational level			
Primary school and lower	5022 (60.1)	33693 (50.5)	<0.0001
Secondary school	3045 (36.5)	30213 (45.3)	
Some postsecondary	286 (3.42)	2827 (4.2)	
Smoking status			
Never smoker	5050 (60.7)	40070 (60.2)	0.0011
Former smoker	890 (10.7)	6438 (9.7)	
Current smoker	2384 (28.6)	20059 (30.1)	
Smoking exposure (pack-years)			
None	5050 (62.7)	40070 (61.7)	<0.0001
0<-<10	720 (8.9)	5801 (9.0)	
10-<25	695 (8.6)	6593 (10.2)	
25-<50	1063 (13.2)	8610 (13.3)	
≥50	530 (6.6)	3771 (5.8)	
Hospital admissions due to severe pulmonary diseases in childhood			
Yes	195 (2.3)	1656 (2.5)	0.4136
No	8158 (97.7)	65074 (97.5)	
Indoor exposure to biomass for cooking or heating			
Yes	3919 (47.0)	28914 (43.4)	<0.0001
No	4418 (53.0)	37772 (56.6)	
Indoor exposure to coal for cooking or heating			
Yes	2890 (34.7)	22881 (34.3)	0.5087
No	5443 (65.3)	43795 (65.7)	
Exposure to dust or chemical at the workplace			
Yes	3477 (41.7)	29808 (44.7)	<0.0001
No	4870 (58.3)	36914 (55.3)	
Family history of lung diseases			
Yes	1837 (22.0)	16085 (24.1)	<0.0001
No	6516 (78.0)	50645 (75.9)	
History of tuberculosis			
Yes	298 (3.6)	1247 (1.9)	<0.0001
No	8055 (96.4)	65483 (98.1)	

*Unweighted estimations were used.

eTable 4 Prevalence of COPD according to GOLD criteria in China

	No.of Participants	Prevalence of COPD (95% CI)	Prevalence of GOLD stage II or higher COPD (95% CI)	Prevalence of COPD with respiratory syndrome (95% CI)
Overall (Weighted)	66752	13.6 (12.0-15.2)	6.1 (5.4-6.7)	4.2 (3.7-4.7)
Overall (Crude)		13.7 (12.5-14.9)	6.0 (5.4-6.5)	4.6 (4.1-5.1)
Age group (Weighted)				
40-49 yrs	21620	6.5 (5.3-7.7)	2.5 (2.0-2.9)	1.5 (1.3-1.8)
50-59 yrs	22134	12.7 (11.1-14.3)	5.3 (4.7-5.9)	3.8 (3.3-4.3)
60-69 yrs	17321	21.2 (18.7-23.8)	9.5 (8.3-10.7)	7.3 (6.2-8.5)
≥70yrs	5677	29.9 (25.8-34.1)	15.6 (13.2-18.0)	10.1 (8.5-11.8)
Ptrend		<0.0001	<0.0001	<0.0001
Men (Weighted)	33137	19.0 (16.9-21.2)	8.3 (7.3-9.3)	6.2 (5.4-7.0)
Men (Crude)		20.0 (18.3-21.8)	8.7 (7.9-9.5)	6.9 (6.2-7.7)
Age group (Weighted)				
40-49 yrs	10401	9.0 (7.5-10.5)	3.4 (2.8-4.1)	2.3 (1.9-2.8)
50-59 yrs	10473	17.8 (15.6-20.0)	7.3 (6.2-8.3)	5.7 (4.9-6.4)
60-69 yrs	9045	30.4 (27.0-33.9)	13.2 (11.7-14.7)	10.8 (9.1-12.4)
≥70yrs	3218	42.3 (37.4-47.2)	21.6 (18.5-24.6)	14.8 (12.5-17.2)
Ptrend		<0.0001	<0.0001	<0.0001
Women (Weighted)	33615	8.1 (6.8-9.3)	3.8 (3.2-4.3)	2.2 (1.9-2.5)
Women (Crude)		7.4 (6.6-8.3)	3.3 (2.9-3.7)	2.3 (1.9-2.6)
Age group (Weighted)				
40-49 yrs	11219	4.0 (2.9-5.0)	1.5 (1.1-1.8)	0.7 (0.5-0.9)
50-59 yrs	11661	7.5 (6.0-8.9)	3.3 (2.6-3.9)	1.9 (1.4-2.3)
60-69 yrs	8276	11.7 (9.7-13.7)	5.6 (4.5-6.8)	3.8 (2.9-4.6)
≥70yrs	2459	18.5 (14.9-22.0)	10.1 (7.8-12.4)	5.8 (4.2-7.3)
Ptrend		<0.0001	<0.0001	<0.0001

eTable 5 Characteristics of participants by region*

	Mean (SD) or % (95% CI)						
	North China (N=9103)	**East China (N=17716)**	**Central China (N=7868)**	**South China (N=6303)**	**Southwest (N=10887)**	**Northwest (N=7895)**	**Northeast (N=6980)**
Age in years, mean (SD)	55.9 (9.1)	57.0 (10.0)	56.2 (9.6)	56.3 (9.7)	55.5 (10.0)	54.0 (9.2)	54.9 (9.5)
Educational level							
Primary school and lower	31.5 (26.4-36.5)	54.4 (48.6-60.1)	52.7 (45.1-60.3)	52.7 (44.1-61.3)	66.6 (58.2-74.8)	48.6 (39.5-57.6)	38.2 (25.5-50.8)
Secondary school	59.5 (54.7-64.2)	43.0 (38.1-48.0)	45.6 (38.2-53.0)	45.2 (36.7-53.8)	30.9 (23.8-38.0)	46.0 (38.3-53.8)	53.6 (43.8-63.4)
Some postsecondary	9.0 (6.9-11.2)	2.6 (1.3-4.0)	1.7 (0.2-3.1)	2.1 (0.5-3.7)	2.5 (1.0-4.1)	5.4 (3.2-7.7)	8.2 (3.8-12.6)
Smoking status							
Never smoker	61.6 (58.2-65.2)	60.4 (57.6-63.3)	60.0 (56.1-64.0)	57.5 (54.1-61.0)	57.8 (53.9-61.7)	64.0 (59.0-69.1)	59.6 (55.6-63.6)
Former smoker	9.7 (8.4-11.0)	10.4 (9.2-11.6)	9.2 (8.1-10.3)	8.6 (7.1-10.1)	9.4 (7.0-11.8)	9.6 (7.7-11.4)	9.9 (8.7-11.1)
Current smoker	28.7 (25.7-31.6)	29.2 (26.7-31.6)	30.8 (27.0-34.6)	33.9 (30.0-37.7)	32.8 (27.9-37.7)	26.4 (21.9-30.8)	30.5 (27.1-33.9)
Smoking exposure (pack-years)							
None	62.7 (58.9-66.2)	61.7 (59.0-64.4)	61.7 (57.5-65.9)	60.2 (56.2-64.2)	60.1 (56.4-63.7)	65.8 (61.0 -70.8)	60.5 (56.6-64.4)
0<-<10	8.9 (7.5-10.4)	7.7 (7.0-8.4)	8.7 (7.2-10.2)	9.3 (7.6-10.9)	9.7 (7.8-11.6)	10.4 (8.5-12.3)	9.4 (7.9-10.9)
10-<25	10.4 (9.5-11.4)	9.3 (8.5-10.1)	9.3 (8.0-10.7)	8.0 (6.5-9.6)	11.6 (10.2-13.0)	10.4 (8.4-12.4)	12.4 (10.7-14.1)
25-<50	12.4 (10.7-14.1)	14.1 (12.7-15.4)	13.6 (11.0-16.1)	14.1 (12.0-16.3)	14.1 (12.0-16.3)	10.7 (8.7-12.6)	13.0 (11.8-14.2)
≥50	5.6 (4.4-6.9)	7.2 (6.0-8.5)	6.7 (4.6-8.8)	8.4 (5.6-11.2)	4.5 (3.5-5.6)	2.7 (1.7-3.6)	4.7 (3.7-5.7)
Hospital admissions for severe pulmonary diseases in childhood (Yes)	2.9 (2.2-3.6)	2.2 (1.8-2.6)	1.9 (1.3-2.6)	2.3 (1.5-3.1)	2.5 (1.9-3.1)	2.5 (1.9-3.2)	3.4 (2.6-4.2)
Indoor exposure to biomass for cooking or heating (Yes) &	17.3 (2.9-31.6)	39.5 (27.6-51.4)	42.6 (28.8-56.4)	46.3 (24.7-67.9)	51.0 (36.9-65.1)	48.1 (29.9-66.4)	55.3 (35.0-75.6)
Indoor exposure to coal for cooking or heating (Yes) &	57.0 (46.5-67.6)	30.9 (15.6-46.2)	37.6 (19.5-55.6)	19.2 (5.1-33.3)	18.0 (1.6-34.4)	49.4 (28.2-70.6)	29.3 (17.4-41.1)
Exposure to dust or chemical at the workplace (Yes)	36.4 (30.9-41.9)	42.2 (36.1-48.3)	45.2 (34.6-55.7)	52.1 (37.4-66.8)	55.2 (45.0-65.5)	40.8 (30.7-50.9)	42.4 (28.1-56.6)
Family history of lung diseases (Yes)	26.3 (23.1-29.5)	25.3 (22.5-28.0)	22.0 (17.4-26.7)	15.6 (12.8-18.4)	23.5 (17.5-29.5)	23.5 (19.7-27.3)	30.0 (26.9-33.0)
History of tuberculosis (Yes)	1.2 (0.6-1.7)	1.7 (1.2-2.1)	1.6 (1.1-2.0)	1.3 (0.7-1.8)	2.0 (1.4-2.7)	1.0 (0.6-1.4)	2.6 (1.6-3.5)
Pulmonary test, mean (SD)							
pre-bronchodilator FEV1	2.63 (0.65)	2.56 (0.69)	2.57 (0.66)	2.39 (0.64)	2.56 (0.72)	2.74 (0.67)	2.63 (0.69)
post-bronchodilator FEV1	2.69 (0.65)	2.62 (0.69)	2.62 (0.67)	2.43 (0.64)	2.62 (0.72)	2.81 (0.67)	2.69 (0.68)
pre-bronchodilator FVC	3.45 (0.83)	3.36 (0.86)	3.34 (0.84)	3.09 (0.79)	3.41 (0.88)	3.65 (0.88)	3.47 (0.86)
post-bronchodilator FVC	3.45 (0.82)	3.36 (0.85)	3.33 (0.84)	3.08 (0.79)	3.42 (0.88)	3.64 (0.88)	3.48 (0.85)
pre-bronchodilator FEV1/FVC	0.76 (0.09)	0.77 (0.09)	0.77 (0.09)	0.77 (0.08)	0.75 (0.09)	0.75 (0.08)	0.76 (0.09)
post-bronchodilator FEV1/FVC	0.78 (0.09)	0.78 (0.09)	0.79 (0.08)	0.79 (0.09)	0.77 (0.09)	0.78 (0.08)	0.78 (0.09)

***** Statistics were unweighted estimations. **&** Combined indoor exposure to biomass or coal for cooking or heating was 54.0 (44.4-63.7) for North China, 53.6 (41.6-65.5) for East China, 66.1 (54.6-77.5) for Central China, 62.9 (47.7-78.1) for South China, 67.3 (55.0-79.6) for Southwest China, 72.1 (63.1-81.1) for Northwest China, and 53.3 (33.4-73.1) for Northeast China.

eTable 6 ORs (95% CI) of region for COPD with progressive adjustment of risk factors

Region	Model 1	Model 2	Model 3	Model 4
Central China	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
North China	1.40 (0.86-2.30)	1.60 (0.90-2.83)	1.59 (0.86-2.96)	1.43 (0.82-2.50)
East China	1.22 (0.95-1.56)	1.25 (0.94-1.65)	1.52 (1.10-2.11)*	1.16 (0.77-1.75)
South China	1.09 (0.86-1.38)	1.13 (0.86-1.49)	1.42 (0.85-2.96)	1.12 (0.62-2.02)
Northwest	1.38 (0.86-1.99)	1.55 (1.04-2.32)*	1.86 (1.13-3.04)*	1.90 (1.25-3.16) *
Northeast	1.63 (1.11-2.38)*	1.97 (1.30-2.99)**	2.30 (1.52-3.48)**	1.88 (1.20-2.94) **
Southwest	2.24 (1.54-3.24)**	2.33 (1.55-3.50)**	2.68 (1.72-4.16)**	2.22 (1.32-3.72) **

Note: *P<0.05,**P<0.01

Model 1: unadjusted.
Model 2: adjusted for age and sex.
Model 3: adjusted for age, sex, PM2.5, ozone.
Model 4: adjusted for age, sex, PM2.5, ozone, residential area, educational level, smoking status, hospital admissions for severe pulmonary diseases in childhood, indoor exposure to biomass for cooking or heating, indoor exposure to coal for cooking or heating, exposure to dust or harmful chemical at the workplace, family history of pulmonary disease, history of tuberculosis, economic development, season of the survey, average temperature and humidity of DSPs in 2015.

eTable 7 Unweighted prevalence of Respiratory Symptoms in Patients with COPD in China

	% (95% CI)					
	Cough (N=9131)	**Sputum (N=9131)**	**Wheezing (N=9034)**	**Dyspnea (N=9101)**	**One of above (N=9063)**	**Chronic cough and phleghm (N=9131)**
All patients with COPD	13.7 (12.4-15.0)	18.8 (17.3-20.3)	8.1 (7.0-9.1)	15.9 (14.2-17.7)	33.7 (31.6-35.8)	5.7 (4.8-6.5)
Age group						
40-49 yrs	11.2 (9.4-12.9)	14.9 (12.8-17.0)	7.3 (5.6-9.0)	8.8 (6.9-10.7)	26.3 (23.3-29.3)	3.3 (2.3-4.4)
50-59 yrs	14.1 (12.0-16.2)	18.7 (16.4-20.9)	8.0 (6.6-9.5)	13.3 (11.1-15.5)	32.9 (29.9-35.8)	5.9 (4.6-7.2)
60-69 yrs	14.2 (12.6-15.9)	19.9 (18.1-21.8)	8.3 (7.1-9.5)	17.8 (15.7-19.8)	35.3 (33.0-37.6)	6.2 (5.1-7.3)
≥70yrs	14.1 (12.2-16.0)	19.7 (17.5-21.9)	8.1 (6.4-9.7)	21.4 (18.7-24.1)	37.3 (34.3-40.3)	6.0 (4.7-7.3)
Ptrend	0.2442	0.0173	0.2336	<0.0001	<0.0001	0.0095
Sex						
Male	15.5 (14.0-17.0)	21.2 (19.6-22.9)	8.1 (7.1-9.1)	14.4 (12.7-16.1)	34.9 (32.8-36.9)	6.5 (5.5-7.5)
Female	9.0 (7.6-10.4)	12.3 (10.7-13.9)	8.0 (6.2-9.7)	19.9 (17.2-22.7)	30.6 (27.7-33.6)	3.5 (2.6-4.4)
P	<0.0001	<0.0001	0.3922	0.0008	0.0002	0.0004
GOLD stages						
GOLD I	10.5 (9.3-11.6)	14.7 (13.2-16.1)	4.3 (3.6-5.1)	9.3 (7.8-10.7)	26.1 (24.1-28.1)	3.5 (2.8-4.1)
GOLD II	15.8 (14.1-17.6)	21.6 (19.7-23.5)	10.4 (9.0-11.8)	19.8 (17.5-22.1)	39.0 (36.4-41.5)	7.3 (6.2-8.5)
GOLD III	27.2 (22.8-31.8)	35.4 (30.1-40.7)	24.4 (19.5-29.4)	46.3 (41.5-51.1)	64.1 (59.1-69.1)	13.4 (9.9-16.9)
GOLD IV	37.2 (27.4-47.1)	46.2 (36.3-56.1)	31.2 (22.6-39.8)	63.6 (53.5-73.7)	83.1 (75.1-91.1)	23.1 (14.1-32.1)
Ptrend	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

eTable 8 General charateristics of patients with COPD

	No of patients	% (95% CI)				
		Overall	**GOLD I**	**GOLD II**	**GOLD III**	**GOLD IV**
History of tuberculosis (Yes)	9131	3.4 (2.8-4.0)	2.6 (2.0-3.2)	4.0 (3.1-4.8)	6.9 (4.9-9.0)	6.4 (0.5-12.3)
Past year exacerbation (Yes)	9130	5.9 (5.2-6.7)	2.6 (2.1-3.1)	7.3 (6.3-8.4)	22.7 (18.8-26.6)	38.5 (27.1-49.8)
Past year hospitalization (Yes)	9130	3.0 (2.5-3.4)	1.0 (0.7-1.3)	3.5 (2.8-4.2)	14.1 (11.0-17.1)	26.9 (18.1-35.8)
Co-morbidities* (Yes)	9131	29.7 (27.9-31.5)	27.0 (25.2-28.7)	33.2 (30.6-35.7)	34.6 (30.4-38.8)	25.6 (16.1-35.1)
Pulmonary heart disease	9131	0.8 (0.6-1.1)	0.4 (0.2-0.6)	1.0 (0.7-1.4)	2.4 (1.1-3.6)	9.0 (2.5-15.4)
Coronary heart disease	9131	5.7 (4.7-6.7)	4.9 (3.8-5.9)	6.7 (5.4-8.0)	8.0 (5.4-10.5)	1.3 (0.0-3.8)
Diabetes	9131	5.3 (4.6-6.0)	5.1 (4.3-5.9)	5.9 (4.8-6.9)	4.6 (2.8-6.3)	1.3 (0.0-3.8)
Hypertension	9131	21.3 (19.7-22.8)	19.2 (17.7-20.7)	24.0 (21.7-26.2)	24.9 (21.0-28.8)	15.4 (7.2-23.6)
Depression	9131	0.5 (0.3-0.6)	0.4 (0.2-0.5)	0.7 (0.4-1.0)	0.7 (0.2-1.3)	0
Osteoporosis	9131	4.4 (3.7-5.2)	4.0 (3.3-4.7)	5.1 (4.1-6.1)	4.9 (2.8-7.1)	2.6 (0.0-5.7)

* The prevalence of co-morbidities was calculated based on self-report data from questionnaires.

eTable 9 Modified MRC dyspnea scale and GOLD ABCD assessment in Patients with COPD

	Overall		Men		Women	
	No. of patients	**% (95% CI)**	**No. of patients**	**% (95% CI)**	**No. of patients**	**% (95% CI)**
Modified MRC dyspnea scale						
Grade 0	7651	84.1(82.3-85.8)	5656	85.5 (83.9-86.4)	1995	80.1 (77.3-82.8)
Grade 1	1037	11.4(10.1-12.7)	686	10.4 (9.0-11.8)	351	14.1 (12.2-16.0)
Grade 2	252	2.8(2.2-3.4)	169	2.6 (2.0-3.1)	83	3.3 (2.3-4.4)
Grade 3	130	1.4(1.1-1.7)	83	1.3 (1.0-1.6)	47	1.9(1.3-2.5)
Grade 4	31	0.3(0.2-0.5)	15	0.2 (0.1-0.4)	16	0.6(0.2-1.0)
GOLD ABCD assessment						
GOLD A	8268	90.9 (90.0-91.8)	6056	91.6 (90.6-92.7)	2212	88.7 (87.1-90.5)
GOLD B	295	3.2 (2.6-3.9)	191	2.9 (2.3-3.5)	104	4.2 (2.9-5.5)
GOLD C	419	4.6 (4.0-5.2)	285	4.3 (3.6-5.0)	134	5.4 (4.3-6.5)
GOLD D	118	1.3 (0.9-1.7)	76	1.2 (0.8-1.5)	42	1.7 (0.9-2.4)

Total 9101 COPD patients were included for mMRC dyspnea scale (33 patients were excluded due to missing data). For GOLD ABCD assessment, 9100 patients were included (1 patient was further excluded due to missing information on history of exacerbation.

eTable 10 Unweighted Awareness, Diagnosis by Spirometry, Treatment of COPD Among COPD Patients

	Awareness		Suspected COPD by Spirometry		Treatment of COPD	
	No.of Participants	**% (95% CI)**	**No.of Participants**	**% (95% CI)**	**No.of Participants**	**% (95% CI)**
Overall	9131	0.9 (0.6-1.1)	9131	5.9 (4.9-6.9)	9134	11.7 (10.2-13.2)
Age group						
40-49 yrs	1315	0.5 (0.1-0.9)	1315	6.2 (4.8-7.7)	1315	7.6 (5.7-9.6)
50-59 yrs	2541	0.7 (0.3-1.0)	2541	5.2 (3.9-6.5)	2542	10.9 (9.1-12.8)
60-69 yrs	3537	1.1 (0.7-1.5)	3537	5.7 (4.6-6.8)	3539	12.4 (10.7-14.1)
≥70yrs	1738	0.9 (0.4-1.4)	1738	7.2 (5.6-8.8)	1738	14.4 (11.8-16.9)
Ptrend		0.7596		0.2746		0.0001
Sex						
Male	6632	1.0 (0.7-1.3)	6632	6.1 (5.2-7.1)	6635	11.0 (9.5-12.6)
Female	2499	0.6 (0.2-0.9)	2499	5.3 (4.0-6.6)	2499	13.4 (11.3-15.6)
P		0.0782		0.1711		0.0426

3 patients were excluded for the calculation of awareness and suspected COPD by previous spirometry due to missing information.

eTable 11 **Population attributable fraction for COPD associated with COPD risk factors**

	OR (95% CI)	Overall		Men		Women	
		Exposure Prevalence among COPD patients (%, 95% CI)	Population attributable fraction (95% CI)	Exposure Prevalence among COPD patients (%, 95% CI)	Population attributable fraction (95% CI)	Exposure Prevalence among COPD patients (%, 95% CI)	Population attributable fraction (95% CI)
Smoking							
Former smoker	1.56 (1.30-1.88)	15.8 (14.6-17.1)	5.7% (3.8%, 7.6%)	20.8 (19.1-22.5)	7.5% (4.9%, 10.0%)	2.6 (1.8-3.4)	0.9% (0.5%, 1.4%)
Current smoker	1.87 (1.60-2.19)	47.7 (45.3-50.0)	22.2% (18.0%, 26.3%)	62.5 (59.9-65.0)	29.1% (23.7%, 34.5%)	8.3 (5.6-10.9)	3.8% (2.4%, 5.3%)
Exposure to dust or chemical at the workplace	1.27 (1.13-1.42)	49.9 (45.7-54.0)	10.6% (6.0%, 15.2%)	53.1 (49.1-57.0)	11.3% (6.4%, 16.1%)	41.3 (35.6-47.0)	8.8% (4.9%, 12.7%)

Population-attributable fraction (PAF) was calculated as Pe[(RR-1)/RR], where Pe is the exposure prevalence among cases and RR was approximated by the adjusted OR from multivariate logistic model in the study (as shown in Table 4). This method is derived by Graubard et al. (**Statist Med**. 437 2007;26[13]:2639-2649) and used by Sarwar et al. (**Lancet** 375[9733]: 2215-2222). Only modifiable risk factors with significant ORs were presented. We noted that the ORs may be subject to the reverse causality and residual confounding given the cross-sectional study design.

eTable 12 **Prevalence of COPD by province in Southwest China.**

Province	No. of Participants	Prevalence of COPD (95% CI)
Tibet	1120	6.2 (4.8-7.6)
Sichuan	3290	25.4 (24.0-26.9)
Chongqing	1531	18.7 (16.7-20.6)
Guizhou	2246	10.8 (9.5-12.1)
Yunnan	2700	13.5 (12.2-14.8)